

Scientific American.

MUNN & CO., Editors and Proprietors.
PUBLISHED WEEKLY AT
No. 37 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS.

One copy, one year, postage included..... \$3 20
One copy, six months, postage included..... 1 60

Club Rates:

Ten copies, one year, each \$2 70, postage included..... \$27 00
Over ten copies, same rate each, postage included..... 2 70

By the new law, postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written, and also state at which time they wish their subscriptions to commence, otherwise they will be entered from January 1st, 1875. In case of changing residence state former address, as well as give the new one. No changes can be made unless the former address is given.

VOLUME XXXII., No. 3. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, JANUARY 16, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

Agassiz monument.....	53	Linseed oil, solvent for (15).....	43
Alcohol, the action of.....	38	Magnetism, destroying (26).....	44
Answers to correspondents.....	43	Magnets, electro (37).....	43
Apples, sweet and sour.....	34	Magnets, insulating (28).....	41
Attachment, an unhappy.....	34	Metals, separating (10).....	41
Batteries for sharpening files (24).....	43	Meter, the French.....	39
Battery for magnet use (2).....	43	Miner in Colorado.....	35
Beaver, giant.....	39	Multiplication and division.....	41
Boiler explosions, steam.....	36	Naval efficiency, our.....	32
Boiler furnaces (8).....	43	Nickel plating (27).....	43
Boilers and sea water.....	43	Oil, inundation of the.....	35
Boilers, zinc in.....	36	Opera glasses, repairing (5).....	43
Book, loss of a valuable.....	34	Oysters, the cultivation of.....	33
Bridging the Niagara river.....	36	Patent decisions, recent.....	42
Bright's disease, cure for.....	35	Patents, American and foreign.....	42
Business and personal.....	43	Patents, list of Canadian.....	44
Cable, the Atlantic (1).....	43	Patents, list of.....	44
Canaries, parasites of (22).....	43	Patents, printing the.....	33
Capitol at Albany, N. Y., the.....	42	Phosphor bronze.....	36
Car, chariot street.....	31	Pipes, sheet metal.....	35
Cement for cloth and paper (17).....	43	Plants, greenhouse and winter.....	35
Cement for rubber (35).....	43	Practical mechanism—No. 15.....	37
Chemical nomenclature.....	38	Prizes for chemical discoveries.....	33
Clare, squaring the (30).....	43	Railway world, the.....	33
Coal vein, mammoth.....	31	Rubber joints, making.....	35
Coffee, making.....	38	Saunders, natural (14).....	43
Cotton chloral (31).....	43	Saunders' sense.....	41
Dyeing hair switches (14).....	43	Sawing steel.....	33
Earthquake and volcanoes.....	34	Silk for insulating (25).....	43
Eclipses (22).....	43	Slate, repairing book (41).....	44
Electric clocks (34, 38).....	43	Stars, the variable (10).....	43
Gas carbureter, new.....	38	Steam and air, mixed (21).....	43
Gas for petroleum (11).....	43	Steam engineering, Turkish.....	37
Glass, amber (20).....	43	Steam power of the world.....	35
Glass, blowing (22).....	43	Steam supply.....	37
Great Eastern and the Centennial.....	33	Steel, oil for hardening (19).....	43
Guns, preserving (13).....	43	Stoppers, to remove.....	39
Iron surfaces, protecting.....	34	Stoves, closing cracks in.....	35
Kittling machine, upright.....	38	Sun's rays, the (21).....	43
Lenses, testing and mounting.....	37	Telegraph engineers, society of.....	39
Light, a new.....	36	Telegraphy, ocean—No. 2.....	40
Lighthouses in the United States.....	39	Telescopes, reflecting (6).....	43
		Tin, spots on (15).....	43
		Tramway, rapid.....	37
		Tunnel, the Mosonnetoos.....	41
		Water pipes (3, 4).....	43
		Wheels, finishing locomotive.....	34

ANSTIE AND DUPRE ON THE ACTION OF ALCOHOL.

About the last literary work of the lamented Dr. Anstie was to describe, in *The Practitioner*, what with unconscious prophecy he called his "Final Experiments on the Elimination of Alcohol from the Body."

Though fatal to a fundamental position of the ultra-temperance party, that alcohol is treated by the body precisely like a poison and eliminated without chemical change, the investigations thus closed will be more fruitful for good to the genuine temperance cause, we believe, than anything else that has been done during the period of Dr. Anstie's labors. Moral and social reform can have no permanent basis other than in truth. And seeing no possible cure for the curse of intemperance except through remedies suggested by real knowledge of the physiological as well as the moral and social problems involved, we cannot but regard Dr. Anstie—notwithstanding the opposition of the nominal temperance party—as one of the truest and most efficient temperance apostles of the time. This in justification, not apology.

The controversy began, some fifteen years ago, on the appearance of M. Lallemand's work, in which, on the evidence of certain qualitative experiments detecting alcohol in the urine, it was asserted that alcohol passes through the system unchanged. This being true, the alcohol contained in wines and other spirituous beverages—as the temperance party were not slow to discover and teach—could be regarded only as a disturbing element, a poison, not only unserviceable to the system but positively harmful.

A result so strikingly in opposition to universal experience could not go long unchallenged. Among others, Dr. Anstie immediately instituted several series of experiments which proved that the idea of the non-destruction of alcohol in the body under normal conditions, and its copious elimination by the kidneys, must have arisen from nothing less than an experimental blunder. Except in conditions of profound alcoholic intoxication, there appeared in the urine only the most minute fraction of any substance which the comprehensive chromic acid test would lead one to believe might be alcohol: a position confirmed by the subsequent researches of Schulz and Drs. Dupré and Thudichum.

In 1867 Drs. Anstie and Dupré together made another series of investigations, covering a period of six months, and carrying the question of elimination as regards the urine to a higher certainty of conclusion. It was found that when, during any twenty-four hours, not more than an ounce and a half of absolute alcohol by volume was taken—whether under the form of beer, wine, or spirit of any kind—it was never possible to obtain evidence of the presence, in the whole day's urine, of more than a small fraction of a grain of

unchanged alcohol, reckoning as such everything that affected the bichromate test. When, however, the daily quantum of one and a half ounces of absolute alcohol was greatly exceeded, a larger portion of alcoholic substance was found in the urine, though never more than one or two grains, notwithstanding as much as three or four ounces of absolute alcohol had been consumed.

These experiments were followed, and in a general way confirmed, in 1870, by those of Drs. Parkes and Wollowicz, who, while admitting that it was quite improbable that any large amount of unchanged alcohol escaped through the kidneys, yet maintained that the amount might be larger than Drs. Dupré and Anstie had estimated, the period of elimination assigned by them being, it was said, too short.

The objection seemed well taken, and Dr. Dupré made, in 1872, a new series of investigations to test the matter more thoroughly. Two unexpected and very important observations resulted. Some time previously Dr. Dupré had established the fact that—contrary to the assumption of Lallemand—it was possible to recover from urine, by distillation, any alcohol it might contain, within an exceedingly minute fraction. He now discovered that there is, in the urine of persons who drink no alcohol, a small quantity of a substance, which not only affects the chromic acid color test precisely as alcohol does, but is similarly convertible into an acid which reacts precisely like the acetic acid derived from alcohol. If it is alcohol, it is certainly not alcohol which has been taken into the body as such, since it appears in the urine of teetotalers. He found further that this small normal constituent of urine represents that minute portion of supposed alcohol which can alone be found in the urine after moderate doses of alcohol. After narcotic doses, however, the larger quantity of material, capable of reacting like alcohol, which appears in the urine, undoubtedly represents a real alcoholic elimination.

As for the temporary retention of alcohol within the system, as had been suggested, to be eliminated by the kidneys at a later period, the facts were altogether adverse. For example, during the course of twelve successive days, during which something over nineteen ounces of alcohol were taken, not one thousandth part was eliminated by the kidneys; and the rate of elimination was no greater at the end than at the beginning of the period. There remained fully nineteen ounces of alcohol to be accounted for: it certainly could not remain unchanged in the system without creating violent disturbance.

Possible eliminations by the skin, the bowels, and the lungs remained to be tested. These were not, and had not been, neglected. Already Dr. Anstie had made many experiments, admittedly rude but still sufficient to prove that no considerable quantity of alcohol escaped by the skin except during dead drunkenness. In 1866 Dr. Dupré estimated the alcohol in the feces of a typhus patient whose daily allowance of brandy was six ounces: the alcohol eliminated by the bowels proved to be less than one tenth of a grain in twenty-four hours.

The question was thus narrowed down to possible elimination by the lungs. This too had been repeatedly tested, and only the most trivial quantities were found to be so eliminated; and as Professor Binz subsequently pointed out, the amount would naturally be overestimated, since the volatile ethers, which we smell in the breath of persons who have been drinking wine, brandy, whisky, and the like, affect the chromic acid test precisely like alcohol. During the twelve days above mentioned, Dr. Dupré found, by methods proved by careful check experiments to be capable of indicating at least two thirds of the alcohol which might pass out with the breath, that about half as much alcohol was eliminated in the breath as in the urine.

Experiments like these would seem to be sufficient to dispose of the elimination theory; but more exacting ones followed, in consequence of Victor Subbotin's study of the action of alcohol on rabbits enclosed in a Pettenkofer chamber, a plan which made it possible for the whole of the excretions—breath, urine, dung, and sweat—to be collected, and the amount of alcohol in them estimated. The experiments made by Subbotin were unsatisfactory in that the doses of alcohol administered were enormous, and the rabbit is an animal specially incapable of withstanding severe alcoholic narcotism.

It was unfortunate at this stage of the investigation that London did not contain a Pettenkofer chamber large enough for research on human beings, and Dr. Anstie and his associate were unable to provide the four thousand dollars which one would cost. So they were forced to content themselves with a smaller apparatus and smaller animals. Dogs were selected, being known to bear alcohol with some approach to human tolerance for that substance. Two healthy terriers were chosen, one (A) weighing 10 pounds, the other (B) weighing 9 pounds 12 ounces.

We have no space for a description of the apparatus prepared, or the processes and precautions taken to guard against deceptive results. Suffice it to say that the experiments on the dog, A, showed that two drams of brandy, containing 47.73 grains of absolute alcohol, can be disposed of by a little terrier within eight hours, with the elimination of only one fifth of a grain of unchanged alcohol by all channels together. It was further ascertained (before brandy had been given) that there was in the dog, as in man, a small normal elimination of substances capable of reacting like alcohol.

With dog, B, the experiments were even more conclusive. For a period of ten days he was given daily one ounce of brandy, containing 190.92 grains of absolute alcohol, administered in two portions. On the eleventh day he was killed, quickly cut into minute fragments—bones, skin, and all—

and the amount of alcohol in him carefully determined: or rather, the whole of the substances in the body and blood capable of yielding acetic acid. The experiments on this dog showed that a terrier of less than ten pounds' weight could take with comparative impunity nearly 2,000 grains of absolute alcohol in ten days; that on the last day of the regimen he eliminated by all channels only 1.13 grains of alcohol; and that on being killed two hours after swallowing half an ounce of brandy, there were recovered from his whole body and all its contents (elaborately treated, so as to provide against material loss during the examination) only 23.66 grains of what might be taken for alcohol, a considerable portion of it due, undoubtedly, to the normal constituents of the unalcoholized body, previously noticed.

These results tally so closely with those obtained from the human organism, by other methods, that it is altogether unlikely that the case against the theory of alcoholic elimination could have been made much more conclusive had Dr. Anstie lived to submit a human subject to the chamber test.

Alcohol in less than narcotic doses is thus evidently disposed of almost entirely within the body. What becomes of it? That it cannot be stored up permanently in the body is proved not only by the experiments above narrated, but by the everyday experience of thousands of drinkers. The excess of ingestion over elimination would long since have stored their bodies with more than their own weight of alcohol, were there no internal disposition made of it. What can that disposition be? Does alcohol play the part of a food?

The complex function of food is (1) to build up the body; (2) to repair waste; (3) to maintain the bodily heat; (4) to evolve energy to be expended in internal and external work. Does alcohol meet any of these requirements?

There is no evidence, thus far, to show that its products can help in any way to form tissues; hence we cannot give it credit for building up the body or repairing waste. On the contrary, it seems rather to retard tissue change, either constructive or destructive. To those who hold the ancient doctrine that physical energy is developed only by tissue destruction, the last-mentioned fact bars the way to any recognition of the possible usefulness of alcohol as a force producer. But every physiologist of standing now admits that the force required for the great bulk of the work done in and by the organism is evolved directly from the food carried to the several organs by the blood, without its previous employment in tissue forming. The objection is therefore groundless.

The apparent inability of alcohol to perform the third part of the function of food, that is, to produce heat, affords another plausible but unsubstantial argument against the possibility of its food action. The observations of Dr. Parkes go to show that, so far from raising the temperature of the body, alcohol slightly depresses it. But too much must not be inferred from this fact. There is no heat-producing food of greater efficiency than beef fat; yet an ounce of beef fat would no more raise the temperature of the body than an ounce of alcohol.

Does alcohol meet the fourth requirement of food? A very large part of the available energy of the body is developed by the oxidation of hydrocarbon, like fat. Being a highly oxidizable hydrocarbon, it would be strange indeed, as Dr. Anstie remarks, if its oxidation did not prove to be the mode by which alcohol disappears within the system. There is much to sustain this view, and not a fact to disprove its correctness. The theoretical force value of the alcohol daily disposed of by multitudes of sober people is very great. It is incredible that so much alcohol can be transformed in the body without the evolution of energy, for good or evil. It does not, in the temperate people in question, produce any visible disturbance of their bodily functions. It must therefore be vitally useful, and belong, where Pavy and universal experience put it, among the force-producing foods, its usefulness depending very largely, it would seem, in the rapidity of its transformation, and the promptness with which it supplies available energy.

This, it is proper to add, with important limitations. Beyond a certain small dosage, perhaps six or eight hundred grains in twenty-four hours for an average adult in health, alcohol is demonstrably a dangerous narcotic poison, not the least of its disadvantages being that it cannot be eliminated to any considerable extent. If employed at all, in health, it is obvious that it should be used for special purposes and with great care, unless it be in the diluted condition in which it appears in cider, beer, or light wine.

In many diseases, the system seems to be able to make use of almost unlimited quantities of alcohol, with strikingly beneficial effects; but that is a field upon which it would be out of place here to enter.

OUR NAVAL EFFICIENCY.

Large standing military establishments have always been justly viewed as unnecessary and inexpedient in this country; and it is the standing argument, of those who would defend the paucity in numbers of our war vessels, that we can afford to remain quiet, watching the development and trial of new systems by foreign nations, gaining experience without sharing in its cost, and simply maintaining a nucleus which, in time of need, the resources of the country could speedily augment to formidable dimensions. In the abstract, certainly, no exception can be taken to this reasoning, but unfortunately practice and theory are at wide variance. Instead of devoting moderate sums to the thorough construction and maintenance in the highest possible efficiency of a small number of vessels which, though even not embodying the very latest refinements, are nevertheless types of their kind, the enormous sum of fifty millions of dollars of the people's money has literally been frittered away during the